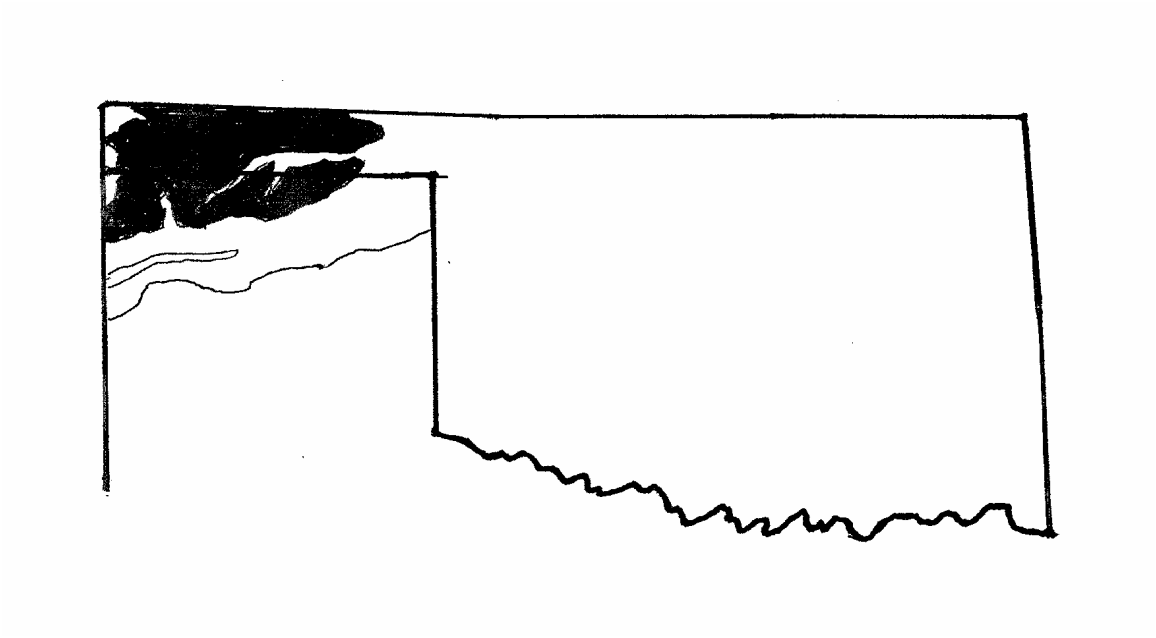
UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION



Texas and Oklahoma Panhandle (MLRA 77A)

ECOLOGICAL SITE CHARACTERISTICS

Site Type: Rangeland

Site Name: Deep Hardland
(Formerly Clay Loam - Texas, Hardland - Oklahoma)

Site ID: R077AY001TX (Texas and Oklahoma)
(Formerly 077AY40TX and 077XY040OK)

Precipitation or Climate Zone: PE 25 – 36 (Southern High Plains)

Original Site Description Approval:
Site Date: 1979 - Texas
8/60 - Oklahoma
Site Author: J.R. Bell, Texas,
unknown, Oklahoma

Revisions:
Revision Date: 12/02
Reviser: J. R. Bell
Revision Approval: Homer Sanchez, Texas, Mark Moseley, Oklahoma
Revision Notes: This site has been correlated for Texas and Oklahoma

PHYSIOGRAPHIC FEATURES:

Narrative: This site is classified as an upland and consists of level to gently sloping smooth plains with little or no relief, and is located on the high plains plateau north of the South Canadian River. The soils are deep, fine textured clay loams and silty clay loams. Slopes range from 0 to 3 % but average from 0.5 to 1.0 %. Depressional basins known as playa lakes occur intermittently in an otherwise level landscape.

Land Form: (1) Plain (2) divide

Aspect: None

	Minimum	Maximum
Elevation (feet):	2500	4500
Slope (percent):	0	3
Water Table Depth (inches):	>60	>60
Flooding:		
Frequency:	None	None
Duration:	None	None
Ponding:		
Depth (inches):	1	2
Frequency:	rare	rare
Duration:	None	Very brief
Runoff Class:	very low	low

CLIMATIC FEATURES:

Narrative: The climate is semiarid continental. Summers are hot with winters generally being mild. Temperature extremes are common. Humidity is generally low, and short-term droughts are common. Wind speeds average 12 mph, and are highest in early spring. The prevailing wind direction is southwest. In the fall and winter, northers are common with severe temperature drops. Cold spells do not generally last more than a few days. Evaporation in summer is high. Open pan evaporation exceeds 6 ft. per year. Most of the precipitation occurs from May to September. Rainfall events often occur as intense showers of relatively short duration. Frequently during the first 15 minutes of a thunderstorm, the rate of rainfall may be 6 to 8 inches per hour. Snowfall average is about 15 inches, but it is not unusual for snowfall to exceed 30 inches every few years. Long term droughts are likely to occur every 20 to 25 years and may last 4 to 5 years. Mean precipitation is around 18 inches but varies significantly from year to year. Rainfall amounts over the last 100 years have varied from as little as 9 inches to as much as 37 inches. The probability is about 70% that precipitation will fall between 14 inches and 23 inches. Growing season averages 195 days. Average first frost is around October 25, and the last freeze of the season should occur around April 1.

	Minimum	Maximum
Frost-free period (days):	195	210
Freeze-free period (days):	190	200
Mean annual precipitation (inches):	16	21
Mean annual air temperature (°F):	54	62
Mean annual soil temperature (°F):	58	61

Monthly moisture and temperature distribution:

	Mean precipitation (in)	Percent precipitation (%)	Avg. Daily Maximum Temperature (°F)	Avg. Daily Minimum Temperature (°F)	Mean temperature (°F)
January	0.45	2.4	49.3	22.0	35.6
February	0.63	3.3	54.7	26.9	40.8
March	1.10	5.9	63.2	33.3	48.2
April	1.20	6.4	73.8	43.9	58.8
May	2.90	15.5	81.4	53.1	67.2
June	3.10	16.6	88.9	62.1	75.5
July	2.90	16.0	91.7	66.5	79.1
August	2.20	11.8	89.4	64.7	77.0
September	1.68	9.1	82.6	57.6	70.1
October	1.15	6.1	74.0	46.0	60.0
November	0.75	4.0	61.5	34.3	47.9
December	0.54	2.9	52.8	25.4	39.0
Mean	18.60	100.0	72.0	44.80	58.5

Climate Stations:

Station ID	Location	From:	To:
TX 8523	Spearman, TX	1920	1999
OK 3628	Hooker, OK	1948	1999
TX 3787	Gruver, TX	1941	1995

INFLUENCING WATER FEATURES:

Non-Stream Characteristics:
Playa lake basins occur randomly spaced over the high plains. These basins capture runoff from adjacent plains drainage areas. These playas are not permanent water. They typically hold water for several months after significant rains fill them, but will go dry during low rainfall years. Playas may contribute some recharge to the underground aquifer in some locations. These playas are considered a separate ecological site.

Stream Characteristics:
There are a few major drainages that carry away runoff water from major rainfall events. These drainages are intermittent and are dry most of the time. A few intermittent water holes may be found along these streams in years of normal or above normal precipitation.

REPRESENTATIVE SOIL FEATURES:

Narrative: The soils are deep, fine textured soils with approx. 30 -35 % clay. They are neutral to very slightly alkaline, slowly permeable, high in inherent fertility, and high in water storage capacity with clay enriched subsoils. Infiltration is of a moderate rate with excellent vegetative cover. They yield water sparingly and the clayey subsoils can be somewhat restrictive to plant root growth. When dry these soils have a tendency to crack and appear droughty although they may still have stored water in the profile. Average depth to caliche varies from 40 to more than 60 inches with 50 inches being average. A major portion of these soils are in crop production.

Major Soil Taxonomic Units correlated to this site include:

Richfield clay loam, Sherm clay loam, Darrouzett silty clay loam, Pullman clay loam. These soils are classified taxonomically as Paleustolls.

Parent Material Kind:	loess
Parent Material Origin:	eolian deposits (high plains)
Surface Texture:	(1) Clay loams, Silty clay loams, and loams
Surface Texture Modifier:	(1) none
Subsurface Texture Group:	Clays, Silty Clays, Silty Clay Loams
Surface Fragments <=3" (% Cover):	0
Surface Fragments>3" (% Cover):	0
Subsurface Fragments <=3" (% Volume):	< 1%
Subsurface Fragments >3" (% Volume):	0

	Minimum	Maximum
Drainage Class:	moderately well drained	well drained
Permeability Class:	slow	moderately slow
Depth (inches):	40	60
Electrical Conductivity (mmhos/cm):	<2	<2
Sodium Absorption Ratio:		
Soil Reaction (1:1 Water) pH:	6.9	7.2
Soil Reaction (0.1M CaC12):		
Available Water Capacity (inches):	4.5	6.5
Calcium Carbonate Equivalent (%):	.2	.4

Plant Communities: Ecological dynamics of the site

The assumed historic climax plant community for this site is a short grass dominated community with a few midgrasses present in small depressional areas, and a few forbs which are very moisture dependent. Very few if any woody plants are present. A few cholla cactus, prickly pear, or occasional yucca will be present. The dominant species of grass is blue grama with a lesser amount of buffalograss. In low places that catch and hold a little more moisture, western wheatgrass and vine mesquite may occur. The major perennial forbs are scarlet globemallow, chocolate daisy, slimleaf scurfpea, prairie coneflower, and baby white aster. Annual forbs are more abundant in years of > avg. spring rainfall and consist of several different species. As a rule, forbs make up around 5 to 8 % of the total production on the average. This site is not highly diverse. The clayey soils in concert with relatively low rainfall limit the range of species adapted to the site. The production potential of the soil is moderately high but its clayey nature causes plant available water to be limited. Drought tolerant species prevail. The species of plants present are in general very palatable to cattle, and were likewise palatable to bison historically. Although the production capability is only moderate, the accessibility due to flat terrain, and the high palatability and digestibility of forage make this a choice grazing site.

Natural fires played a major role in maintaining the plains grasslands. In general, woody plants were suppressed and grasses were perpetuated. When this site burned, forb growth was most likely more profuse for a year or two following the fire. This attracted animals that prefer forbs to grasses, such as the pronghorn. Although fire was a common occurrence on the shortgrass plains, it was probably more important to the maintenance of the tall and midgrass prairies further east. Climate was of greater importance in maintaining the shortgrass communities. Fire limited the encroachment of trees in the tall grass regions while dryness probably was more of a limiting factor in the shortgrass region. Fire also influenced grazing patterns as bison and pronghorn and other animals were attracted to the burned areas since the regrowth of herbage was more nutritious and more palatable than old growth. Most of the shortgrasses are

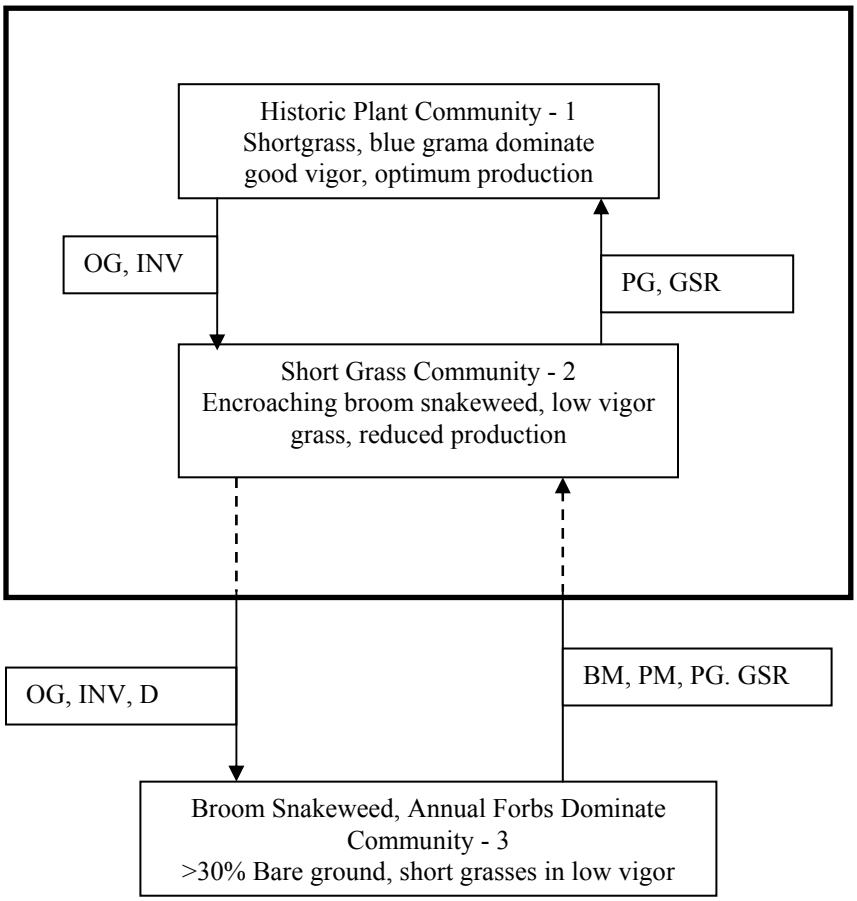
considered fire neutral as to their response. Generally, this site does not produce the amounts of fine fuel needed to generate the amount of heat needed to kill woody vegetation. An exception to this may be plains prickly pear. The good palatability of the forage on this site makes it unnecessary to consider burning for improving forage quality. Prescribed fire is not often applicable as a management tool.

This site developed under a grazing regime, as did all sites in this region. This regime included bison, prairie dogs, antelope as well as smaller animals such as rodents and rabbits. Many ecologists consider the plant community of pre-settlement times to be a grazing dis-climax. Large herbivores grazed the grasslands and moved on seeking fresh forage. On the high plains plateau, the frequency of grazing was greatly influenced by availability of water. Animals could water in the rivers such as the Canadian most of the year but out on the plains, water was often scarce. Whether or not the playas contained water probably affected the movements of the grazers as well as whether or not the few major drainages had water holes available. When grazing did occur it was probably severe. But the recovery periods were likely long with the animals not returning to the same spot for as long as a year or even more. When overgrazing occurs and continues over a long period of time, the blue grama loses its bunch grass character and assumes a sod bound appearance because of grazing pressure. This leads to a low vigor plant community with lowered production potential. With the insufficient soil protection of low vigor grasses, the soil becomes more compacted, infiltration is reduced and runoff is increased. It forms a cycle that cannot be broken unless longer rest periods are reinstituted to restore vigor and grazing practices are moderated. With heavy grazing, western wheatgrass and vine mesquite will decrease over time. Long term abuse coupled with drought can leave the turf open in places and invading species can gain a foothold. Broom snakeweed is an opportunistic species that will invade this site, especially if the grass cover is weak. Broom snakeweed is also cyclic. The short grass species are so resistant to grazing that it is not common for them to actually be killed out, but they can be weakened dramatically. Rest and possibly control of invading competition will usually restore this site within a few years provided that judicious grazing management is also applied. This site is perhaps one of the most resilient provided abuse is not prolonged.

Historically, this site made up a large percentage of the high plains grassland. Most of this land has been put to cultivation and it is rare to find more than a few hundred acres of contiguous hardland site. As is the case with all sites, a healthy vigorous plant community helps to insure that all the various ecological processes take place unimpeded. On this site, good plant cover is absolutely essential for the water cycle to function efficiently due to the high evaporation rates and the chance for overland runoff due to slow permeability of the soils.

PLANT COMMUNITIES AND TRANSITIONAL PATHWAYS (DIAGRAM)

Narrative: The following diagram suggests some pathways that the vegetation on this site might take. There may be other states not shown on the diagram. This information is intended to show what might happen in a given set of circumstances; it does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.



Legend:
OG = Overgrazing
PG = Prescribed Grazing
GSR = Growing Season Rest
BM = Brush Management
PM = Pest Management

= Threshold

State and Transitional Pathways (continued)

Changes in the structure and composition of the plant community may be due to management, natural occurrences or both. At some point in time thresholds are crossed as indicated by the dark-lined box on the State and Transition Diagram. This suggests that once changes have progressed to a point, the community has been altered to the extent that a return to the former state is not possible unless accelerating practice is applied to make it happen. These changes take place on all ecological sites, but some sites support communities that are more resistant to change than other sites. Also, some sites are more resilient and heal or restore themselves more easily. Usually, changes in management practices alone, such as grazing techniques, will not be sufficient to restore former plant communities once the threshold has been crossed. An example of energy input might be the implementation of chemical brush management to decrease the amount of woody shrubs and increase the amount of grasses and forbs. This shift in community balance could not be brought about with grazing alone. The amount of energy required to bring about a change in plant community balance may vary a great deal depending on the present state and upon the desired result.

On this site, the short grass community is resilient and the blue grama and buffalograss are capable of standing a lot of grazing pressure without significant plant mortality. However, grazing abuse will lead to sod-bound, low producing plants. In addition, weedy and/or shrubby species such as broom snakeweed often increase when this situation prevails for a long period of time. Grazing management alone may correct the situation but it may also require control of the competitive shrubs. Once the turf of shortgrasses has been destroyed and halfshrubs and annuals completely dominate, reseeding may even be necessary.

Plant Community Name: Shortgrass – Blue grama dominant, presumed historic climax

Plant Community Sequence Number: 1

Plant Community Narrative: The interpretive plant community for this site is the presumed historic climax plant community. It is a short grass dominated community with blue grama being the dominant grass. Buffalograss may make up as much as 20% of the total production. There are a few other species of short grasses present making up from 5 to as much as 10 % of total production. Western wheatgrass and vine mesquite are often present in micro lows and on slopes above playa lakes. There are approximately 5 % forbs and almost no woody shrubs or trees present.

Plant Community Annual Production (by plant type): Air Dry Weight

Plant type:	Low	RV	High
Grass/grasslike	800	1300	1700
Forbs	40	100	120
Shrub/vine	30	40	45
Microbiotic crust	15	20	25
Total	885	1460	1890

Grasses and Grasslikes (1300 pounds per acre)

Group	Scientific Name	Common Name	Species Production	Group Production
1	Bouteloua gracilis	blue grama	875	1125
1	Buchloe dactyloides	buffalograss	250	
2	Pascopyrum smithii	western wheatgrass		60
2	Panicum obtusum	vine mesquite		
3	Bothriochloa laguroides	silver bluestem		115
3	Chloris verticillata	tumble windmill grass		
3	Eragrostis curtipedicellata	gummy lovegrass		
3	Muhlenbergia arenicola	sand muhly		
3	Sporobolus cryptandrus	sand dropseed		
3	Aristida purpurea	Wright threeawn		

Forbs (100 lbs. per ac)

4	Sphaeralcea coccinea	scarlet globemallow		100
4	Tetraneuris scaposa	plains actinea		
4	Thelesperma filifolium	plains greenthread		
4	Liatris punctata	dotted gayfeather		
4	Berlandiera lyrata	chocolate daisy		
4	Penstemon fendleri	Fendler penstemon		
4	Penstemon fendleri	Engelmanndaisy		
4	Psoralidium tenuiflorium	slimflower scurfpea		
4	Ratibida columnifera	prairie coneflower		
4	Chaetopappa ericoides	baby white aster		
4	Guara coccinea	scarlet gaura		
4	Ambrosia psilostachya	western ragweed		
4	Artemisia ludoviciana	Louisiana sagewort		
4	AAFF	annual forbs		
4	ONAGR	primrose species		

Shrubs (40 lbs. per acre)

5	Opuntia imbricata	Tree cholla		40
5	Yucca glauca	plains yucca		
5	Gutierrezia sarothrae	broom snakeweed		
5	Opuntia polyacantha	plains pricklypear		

Growth curve number: OK0001

Growth curve name: Blue grama/buffalograss in good vigor, few forbs, occasional cholla plants.

Growth curve description: Approximate historical plant community

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0	2	4	7	20	24	18	9	12	5	2	1

Plant Community Name: Low vigor shortgrass community w/ some annuals & broom snakeweed encroachment.

Plant Community Sequence Number: 2

This plant community shows sod bound blue grama and buffalograss. There is some invasion of annual forbs and broom snakeweed. Low vigor causes the production to be low. Grazing use has been excessive for several years. This community can be restored close to the historic climax with growing season rest and prescribed grazing for several years. If the snakeweed continues to increase, some control may be needed to fully restore the community.

Plant Community Annual Production (by plant type): Air Dry Weight

Plant type	Low	RV	High
Grass/grasslikes	400	500	650
Forbs	40	50	80
Shrubs	80	100	160
Microbiotic crust	5	10	20
Total	525	660	910

Growth curve number: Not assigned.
Growth curve name: Low vigor short-grass

Growth curve description: Low vigor shortgrass with broom snakeweed encroaching, some increase in annual forbs.

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0	1	3	5	20	25	17	8	15	4	1	1

Plant Community Name: Domination of broom snakeweed and annuals. Increased bare ground.

Plant Community Sequence Number: 3

Blue grama and buffalograss are in low vigor with large amounts of bare ground. Broom snakeweed dominates the community. Production is low and community integrity has been compromised. Ecological processes are not functioning as needed. Runoff is increased and infiltration is low. This type of vegetative state is typical where considerable disturbance has occurred.

Broom snakeweed and annuals dominate plant community. Some poor vigor shortgrass remains, bare ground is evident, and production of grass is low. Production of halfshrubs and annuals is greater than grass. This area is an abandoned prairie dog town. Severe grazing by prairie dogs over several years has caused sufficient soil disturbance to allow weedy species to proliferate. Severe and prolonged overgrazing by livestock can also bring about this state.

Plant Community Annual Production (by plant type): Air Dry Weight

Plant type	Low	RV	High
Grass/grasslikes	250	300	400
Forbs	120	150	200
Shrubs(halfshrubs)	200	250	300
Microbiotic crusts	20	40	50
Total	590	740	950

Growth curve number: Not assigned.

Growth curve name: Broom snakeweed and annuals.

Growth curve description: Halfshrub dominant, with low vigor shortgrass, increased annuals.

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0	2	5	18	23	16	5	5	8	15	3	0

ECOLOGICAL SITE INTERPRETATIONS

Animal Community: Native animals that occupy this site include scaled quail, pronghorn antelope, coyote, jackrabbit, swift fox, Texas horned lizard, prairie dogs and various small mammals and grassland birds. It is an open grassland site therefore, species that require cover will not be resident. **.** For specific guidance on wildlife, Wildlife Habitat Appraisal Guides are available through NRCS for several species.

Plant preference by animal kind: This rating system provides general guidance as to animal preference for plant species. It also indicates possible competition between kinds of herbivores for various plants. Grazing preference changes from time to time, especially between seasons, and between animal kinds and classes. Grazing preference does not necessarily reflect the ecological status of the plant within the plant community. (P = preferred, D = desirable, U = undesirable, N = not consumed, X = used, but degree of utilization not known, T = toxic)

Animal Kind: Domestic livestock

Animal Type: Cattle

Common Name	Scientific Name	Plant Part	J	F	M	A	M	J	J	A	S	O	N	D
blue grama	Bouteloua gracilis	Leaves	P	P	P	P	P	P	P	P	P	P	P	P
buffalograss	Buchloe dactyloides	Leaves	P	P	P	P	P	P	P	P	P	P	P	P
western wheatgrass	Pascopyrum smithii	Leaves	D	D	P	P	D	U	U	U	U	P	P	D
vine mesquite	Panicum obtusum	Leaves	D	D	D	D	D	D	D	D	P	P	D	D
sand dropseed	Sporobolus cryptandrus	Leaves	U	U	U	D	D	D	D	D	D	D	D	U
silver bluestem	Bothriochloa laguroides	Leaves	D	D	D	D	D	D	D	D	D	D	D	D
perennial threeawn	Aristida purpurea	Leaves	U	U	U	X	X	U	U	U	U	U	U	U
sand muhly	Muhlenbergia arenicola	Leaves	U	U	U	U	U	U	U	U	U	U	U	U
tumble windmillgrass	Chloris verticillata	Leaves	U	U	U	D	D	D	D	D	D	U	U	U
gummy lovegrass	Eragrostis curtipedicellata	Leaves	U	U	U	D	D	D	U	U	U	U	U	U
scarlet globemallow	Sphaeralcea coccinea	Leaves	N	N	N	D	D	D	D	D	D	D	N	N
plains actinea	Tetraneuris scaposa	Leaves	U	U	U	U	U	U	U	U	U	U	U	U
plains greenthread	Thelosperma filifolium	Leaves	N	N	N	D	D	D	U	U	U	U	N	N
dotted gayfeatehr	Liatris punctata	Leaves	N	N	N	U	U	U	U	U	U	U	N	N
chocolate daisy	Berlandiera lyrata	Leaves	N	N	N	X	X	X	X	X	X	N	N	N
Fendler penstemon	Penstemon fendleri	Leaves	N	N	N	U	U	U	U	U	U	N	N	N
Engelmanndaisy	Engelmannia peristenia	Leaves	N	N	X	D	D	D	D	N	N	N	N	N
wild alfalfa	Psoralidium tenuiflora	Leaves	N	N	N	D	D	D	D	U	U	N	N	N
primrose sp.	Onagraceae sp.	Leaves	N	N	N	D	D	D	D	D	D	N	N	N
prairie coneflower	Ratibida columnaris	Leaves	N	N	N	U	U	U	U	U	U	N	N	N
baby white aster	Leucelene ericoides	Leaves	N	N	N	U	U	U	U	U	U	N	N	N
scarlet gaura	Gaura coccinea	Leaves	N	N	N	D	D	D	D	D	D	N	N	N
western ragweed	Ambrosia psilostachya	Leaves	N	N	N	U	U	U	U	U	U	N	N	N
sagewort species	Artemisia species	Leaves	X	X	X	X	X	U	U	U	U	U	X	X
annual forbs	Annual forbs	Leaves	X	X	X	D	D	D	X	X	X	X	X	X
cholla cactus	Opuntia imbricata	Stems/fruit	U	U	U	U	U	U	U	U	U	U	U	U
plains yucca	Yucca glauca	Flowers	U	U	U	U	D	D	U	U	U	U	U	U
plains prickly pear	Opuntia polyacantha	Pads/fruit	U	U	U	U	U	U	U	U	U	U	U	U
Broom snakeweed	Gutierrezia sarothrae	Leaf/Stem	T	T	T	T	T	T	T	T	T	T	T	T

Animal Kind: Pronghorn

Annual forbs		**leaves**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**
Scarlet globemallow	Sphaeralcea coccinea	leaves	N	N	N	P	P	P	P	P	P	P	N	N
Baby white aster	Leucelene ericoides	stems	X	X	X	P	P	P	X	X	X	X	X	X
Wild alfalfa	Psoralea tenuiflora	Stems/leaf	N	N	N	D	D	D	D	D	D	N	N	N
Primrose	Onogracae spp.	leaves	N	N	N	P	P	P	X	X	N	N	N	N
Engelmanndaisy	Engelmannia pinnatefida	leaves	N	N	P	P	P	P	N	N	N	N	X	X
Prairie coneflower	Ratibida columnaris	leaves	N	N	D	D	D	X	X	X	X	N	N	N
Western wheatgrass	Pascopyrum smithii	leaves	D	D	D	D	N	N	N	N	N	N	N	D
Annual cool season		leaves	D	P	P	P	N	N	N	N	N	N	N	D

grasses

Hydrology Functions: This site is flat terrain so runoff is slow. Runoff from the site supplies the playa lakes with water goes into the few major draws and streams that are associated sites. With good cover, runoff contains low sediment. Infiltration is moderately slow and evaporation relatively high. If cover is poor very little water gets into the soil.

Recreational Uses: Hunting, Camping, Hiking, Birdwatching, Photography, Horseback Riding

Wood Products: No wood products are found on this site.

Other Products: None

SUPPORTING INFORMATION

Associated Sites: Sites that normally occur in proximity to Hardland sites are: Limey Upland, Loamy, and Very Shallow sites. Playa lakes are closely associated with hardland sites and are considered a separate site.

Similar Sites: Hardland Slopes sites are similar in vegetation but have more slope and are a transitional site between the plains and the breaks.

Inventory Data References (narrative): Based on long-term observation of well-managed ranges, range inventory data, and numerous historical accounts of vegetation present at time of settlement.

Inventory Data References:

Clipping data (417's),
NRCS FOTG section IIE Range sites,
Gould's Grasses of Texas,
Ecological Checklist of Vascular Plants of Texas,
Panhandle Plains Historical Review,
The Texas Panhandle Frontier by Frederick W. Rathjen,
Ecological Implications of Livestock Herbivory in the West by Vavra, Piper and Laycock,

State Correlation: Oklahoma and Texas

Type locality: **These type localities are sensitive data**

Other References or Reviewers:

Dr. Ron Sosebee, Department of Range, Wildlife and Fisheries Texas Tech University, Lubbock, Texas

SITE DESCRIPTION APPROVAL:

Mark Moseley
State Range Conservationist
Stillwater, Oklahoma
May 27, 2003